WILDLIFE CONNECTIVITY ACROSS UTAH'S HIGHWAYS

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UDOT
GOING THE EXTRA MILE

UDOT ENVIRONMENTAL SERVICES REPORT ABSTRACT

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16. Abstract:

On May 11 and 12, 2004, the Utah Department of Transportation sponsored a workshop to identify major sections of Utah's highways that serve to disrupt wildlife connectivity. This workshop was attended by representatives from the Utah Department of Transportation, Utah Division of Wildlife Resources, U.S. Forest Service, U.S. Fish and Wildlife Service, and several private consulting and conservation groups.

During the workshop, and subsequently in some of the DWR offices, 64 separate connectivity zones that are bisected by Utah's highways were identified. From this, it is estimated that 37 miles of Utah's roads and freeways cross through connectivity areas considered critically important to wildlife, 83 miles of roads cross through high priority areas, and 973 miles cross through moderate priority areas.

Each of these connectivity zones are described in detail in the Appendix at the end of this report

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EXECUTIVE SUMMARY

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Increasing population and economic growth have contributed to higher traffic volumes on Utah's highways. This, in turn, has led to increasing wildlife-related safety problems. Most of Utah's highways and freeways bisect wildlife habitat. Affected wildlife species may be as small as fish, mice, prairie dogs, rabbits, tortoises, etc., or as large as deer, elk, or moose. According to Marshik, et. al. (2001), "In the United States, an estimated one million vertebrates-amphibians, reptiles, birds, and mammals are killed on roads and highways each day."[1]

When wildlife habitat is bisected, animals still have a need to cross the barrier to access their native habitat. Often, due to roadway width, traffic volumes, or other constraints, they are unable, or unsuccessful. This causes what is known as "habitat fragmentation." Habitat fragmentation, and the creation of "fracture zones," can be viewed as a loss of "habitat connectivity." This loss in connectivity is one of the major transportation-related issues DOTs need to address. Wilcox and Murphy (1985) stated, "Habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis."[2]

According to Gore, et al. (2001), "Wildlife habitat connectivity is affected by many human activities including highway development, private and public land management practices, open space policies, subdivision policies, road access and densities, and many other factors."[3]

Animals crossing roads as they attempt to connect with their natural habitat often pose a safety hazard to motorists. Many species can become trapped on highways by barriers or headlights. Other species either fear to cross these barriers, or are physically incapable of doing so, such as desert tortoises, amphibians, reptiles, small mammals, etc. Thus, there is a need for some mechanism to assist these species in crossing.

According to Ruediger (2001), "The primary objective of wildlife and fish crossings is to maintain habitat and population connectivity. For many species, this may require maintaining or simulating the natural functions of their habitat within or on top of traffic crossing structures.

Many crossings are designed to facilitate movement of a single or small number of species. Structures would be more functional if connectivity of habitat across highways were given more consideration. More species would be provided for, especially plants, invertebrates, and small animals, if habitat connectivity were at least as important as providing crossings for a few target species. Connectivity of habitat and populations is an ecosystem approach."[4]

STUDY OBJECTIVES

Methods

On May 11 and 12, 2004, the Utah Department of Transportation sponsored a workshop to identify major sections of Utah's highways that serve to disrupt wildlife connectivity. This workshop was attended by representatives from the Utah Department of Transportation, Utah Division of Wildlife Resources, U.S. Forest Service, U.S. Fish and Wildlife Service, and several private consulting and conservation groups.

The objectives of this workshop included:

1. Identify where wildlife linkage areas cross Utah's road system.
2. Identify species involved in these linkage areas.
3. Suggest possible solutions to fragmentation.

For this meeting, large (44" x 48") maps of Utah's highway and freeway system were made available for marking of connectivity zones, or linkage areas, across these roads. Data sheets were made available for note taking and identification of the problems exhibited in the connectivity zones. Participants were separated into six groups, based roughly on UDOT's six regions and districts.

In this analysis, several key questions were asked on the data sheets:

- Linkage Name
- UDOT Region/District
- Highway or Route Number
- Mileposts
- Conservation Issues Involved
- Species of Concern in each linkage area.
- Comments and/or recommendation

Priorities were assigned to each connectivity zone based on the participants' knowledge of the locales, ecosystems, resident species, habitats, etc. Priorities were classified as critical, high, or moderate. It was assumed that the rest of the state, with no clear connectivity areas, is low priority. The resulting data and information were then compiled and digitized into a GIS format.

Discussion of Suggested Practices

During the workshop, and subsequently in DWR offices, 64 separate connectivity zones that are bisected by Utah's highways were identified. From this work, it is estimated that 37 miles of Utah's roads and freeways cross through connectivity areas considered critically important to wildlife, 83 miles of roads cross through high priority areas, and 973 miles cross through moderate priority areas.

Each of these connectivity zones is described in detail in the Appendix. The suggested practices generally fall into a few categories: fencing, wildlife crossings, and signing, including infrared sensors, being the most common suggestions given. Below is an explanation of the recommendations that have been offered.

Fencing

By far, most of the suggestion practices to protect wildlife involved maintaining and/or installing wildlife exclusionary fencing.

For deer and elk, this should be what UDOT calls a “Type G” exclusionary, or deer barrier fence (Figure 1). This fencing is made of wire with “V”-shaped mesh and minimally eight feet tall as shown in Figure 1. Where snowdrifts commonly become deep against the fence, this height should be increased up to 12 feet.

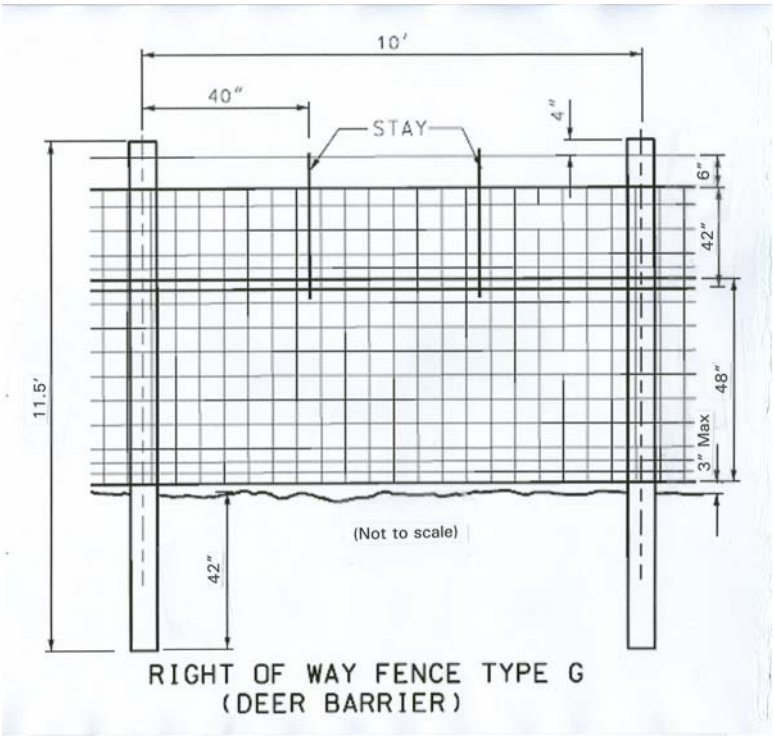

Figure 1

All deer/elk proof fencing must include earthen escape ramps, preferably the newly designed “wildlife crossover standard” recently approved by UDOT’s Standards and Specification section of the Project Development Division.

For antelope, UDOT should use a standard four-feet-high, five-wire fence, with a smooth bottom wire, 18 inches above the ground level to allow them to crawl under so they can connect with their habitat across the highway.

To be effective, fences need to be maintained annually and gates need to be kept closed, or replaced by double cattle guards, or cattle guards modified for deer (see example Figure 2).

Figure 2 **Photo courtesy Unknown**

Overpass/Underpass with fencing

Closely associated with fencing is the need for overpasses or underpasses to facilitate wildlife crossing highways. These are especially important in connectivity zones, where animals need to migrate across highways and freeways.

To be effective, such structures require fencing with escape ramps to funnel wildlife into these structures.

There are several types of crossing structures that can be used including landscaped overpasses such as those on the Trans-Canada Highway near Banff, Canada, (Figure 3), or bridges (Figures 4 & 5), box culverts (Figure 6), and elliptical culverts (Figure 7), etc. Generally, overpasses work best for most species, but underpasses can work well too if designed properly.

Figure 3 **Photo Courtesy Paul West**

Figure 4 **Photo Courtesy Paul West**

Figure 5 **Photo Courtesy Utah Division of Wildlife Resources**

Figure 6 **Photo Courtesy Utah Division of Wildlife Resources**

Figure 7 **Photo Courtesy Utah Department of Transportation**

With the exception of overpasses, V-shaped bridges that are wide at the top, as shown above in Figures 4 and 5, seem to work best because of their naturalness and openness. If designing for deer, using sloped-back (2 to 1 or less), natural ground for the abutments helps as deer normally use the sloped sides, rather than the floor.

Underpasses can also be culverts for deer, but recent research from the Arizona Department of Transportation suggests they do not work well for elk[5,6]. For big game, they should be designed at least 9 feet high for deer and 16 feet high for elk, with an aspect/length ratio of 2.7 (English units) or greater. This means the square dimension of the opening should be at least 2.7 times the length of the structure. Where possible, daylighting culverts in center medians also helps deer to overcome their fright of new structures.

Signs

Many of the workshop participants suggested using some kind of signs to warn motorists of wildlife in the right-of-way.

A common comment is that the general public can become used to seeing signs, so to be effective, they need to be large and eye catching, possibly with flashing lights, and preferably used only seasonally when animals are migrating through the area in the fall and spring.

Some new sign innovations include infrared sensors. When animals wander onto the right-of-way, these sensors would detect their movements and trigger flashing lights on warning signs. Another variation is to place video cameras along critical stretches of highway that would take video photographs of the animals and relay these to a screen that motorists can view as they drive past the monitor. This would help motorists realize that these warning signs are serving a real purpose.

Other Important Suggestions

Reduction of speed limits may help in some instances as well. Where sight distance is limited by poor geometrical design, or heavy vegetation against the right-of-way, reduced speed limits can help if motorists adhere to them.

Roadside vegetation management, especially when coupled with water development, can also have a positive effect on wildlife mortality on highways. Keeping the right-of-way mowed and cleared of brush helps motorists to see animals that may be ready to jump in front of a vehicle. Often, the reason wildlife cross highways may be to access water. Development of new water developments, such as guzzlers, may help to reduce this need.

Results and Conclusion

In the following appendix are maps of the UDOT regions and districts showing the known wildlife connectivity zones. Following the maps are tables giving specific details and suggested solutions and recommendations for each wildlife connectivity zone.

Emphasis must be placed on encouraging UDOT's planners and engineers to incorporate wildlife mitigation measures into new highway/freeway designs, including exclusionary fencing with escape ramps, crossing structures, signage, etc. Highways should not become a barrier to wildlife movement.

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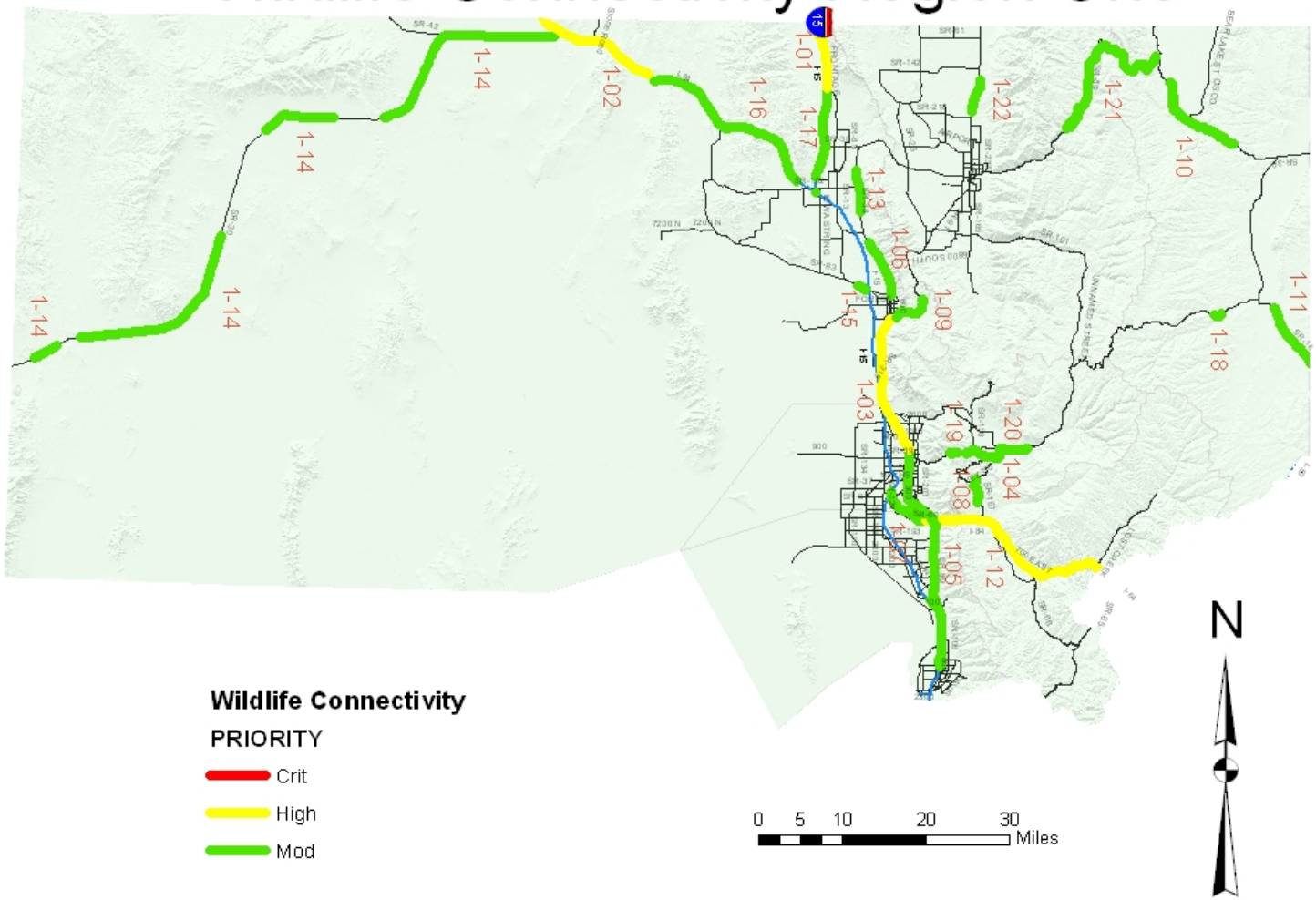
APPENDIX

UDOT Region 1:

Wildlife Connectivity Region One



Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	1-01	Plymouth Area	I-15	395 to 402	Big Game Highway Safety Connectivity to Public Lands	Deer	Mostly private land along I-15, but high deer kill. Mostly grain fields.	Need deer-proof fencing with escape ramps and some kind of crossing structure every mile or so
High	1-02	Snowville Area, Utah and Idaho	I-84	0 to 15	Big Game Highway Safety State Sensitive Species Connectivity to Public Lands Highway safety	Badger Deer Sage Grouse Raptors	Migratory corridor for deer. Badger and sage grouse habitat on both sides of highway. Public lands on both sides of highway	Need to fence both sides of freeway with escape ramps and some kind of crossing structure every mile or so.
High	1-03	Brigham City South	U.S. 89	355 to 372	Big Game Highway Safety	Deer	Nuisance deer herd, road safety	Need deer-proof fencing with escape ramps
Moderate	1-04	Highway 39	SR-39	14 to 19	Big Game Highway Safety	Deer	None offered	Seasonal warning signs might help.
Moderate	1-05	Highway 89	U.S. 89 I-15	334 to 355 320 to 328	Big Game Highway Safety	Deer	Deer killed while crossing highway. Some are urban resident deer while some are migrating down from mountains to winter near the river. Problem area w/houses, road, RR crossings, etc. Jersey barriers also appear to a problem by trapping raccoons crossing.	Modify barriers.
Moderate	1-06	Honeyville to Dewyville	SR-38	0 to 7	Big Game Highway Safety	Deer	None offered	Seasonal warning signs might help

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-07	Riverdale to South Weber – Uintah Area	I-80	82 to 86	Big Game Highway Safety	Deer	Deer are killed crossing the highway - resident deer live below Hill Air Force Base bluff, and sub-divisions and fields. They seem to cross to the riparian habitats. Concern is more for highway safety issues than connectivity issues – approximately 25 - 40 deer are killed each year.	Speed Limits? Infrared Sensors?

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-08	Trappers Loop Road	SR-167	4 to 7	Big Game Highway Safety	Moose	Morgan County portion of Trappers Loop Road is worse than the Weber County portion. Approximately 15 moose are killed every year in this area. Yearlong residents so no real migration issues. This may get worse with developments proposed for this area. The whole road has problems, but most are killed in the 3 – 4 mile stretch. Situation may get worse as more sub-divisions are developed and animals are forced to move more often to find better habitat. Infrared sensors that could let drivers know an animal is in the vicinity might help.	Suggest seasonal warning signs, and lower speed limits where moose are a problem.

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Moderate	1-09	Sardine Canyon	U.S. 89/91	3 to 8	Big Game Highway Safety	Deer	Deer are still accessing busy corridor. Heavy snow causes problems to fence and deer are moving just when snow melts so no time to maintain fence properly. An important navigation corridor	Better fence maintenance Retrofit existing underpasses to encourage deer use Add cattle guards to gates which are constantly left open Replace/remove/return gates near Mantua that don't close behind deer and that allow other deer to access/re-access highway

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	1-10	Laketown Canyon	SR-30	120 to 132	Big Game Highway Safety	Deer	Migration route for deer, cross in Laketown Canyon. Winter range is on both sides of canyon (steep) so animals are frequently on the road and are killed. UDWR biologists are doing a study this year to collar animals to determine where and when they cross the canyon. 100+ deer are killed/year (mainly fall/winter kills) 15 to 20 deer killed/year. A group of resident deer cross highway on evenings to drink from Bear Lake. Herd unit is under objective and sportsmen want us to increase herd #'s	Code deer herd area. We asked UDOT to sign this canyon 1½ - 2 years ago and we were told that signs in this area were not a priority for UDOT. Overpass would make the most sense. Could fence draw to force animals to cross in a different area, but this may more widely disperse animals and cause more problems. Signs would probably work best.
Moderate	1-11	Outside Evanston	SR-16	0 to 8	Big Game Highway Safety	Pronghorn	Antelope are killed due to net wire fencing on both sides of highway.	4-strand barbed wire, smooth bottom strand about 16" above ground.
High	1-12	Mountain Green, to Echo Junction.	I-84	87 to 119	Big Game Highway Safety	Deer Elk Fish Songbirds Amphibians	R.P. 112-120 elk hot spot. R.P. 149-156 deer hot spot. Yearlong mortality, but kill increases during	Please give this some serious thoughts – especially with Governor Walker's Waterbody Program! We could at least improve aquatic habitat with cross

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
							migration. About 300 deer are killed per year in this area during a normal, average snow year. More during heavy winters periods. Round Valley area historically picks up 100 deer per month. The Weber River in Weber Canyon between the freeways. This reach is very impacted, with no floodplain and no riparian area. Although this area may be relatively inaccessible to angling, good habitat should grow larger fish, which could potentially move out of the reach into more fishable areas. Jersey barriers create movement problems to small to medium sized wildlife that get on the highway? Hundreds of animals are killed every year. The Weber River in	vanes and log (large woody) structures. Another good idea for a collaborative effort. Could Jersey barriers either be removed or modified with holes underneath that would allow animals to crawl underneath. DWR and UDOT should coordinate efforts to restore stream meanders and floodplain connectivity near Henefer Since some of the sportsman's dollars are to mitigate the impacts of I-84, it would seem appropriate that UDOT help fund some stream rehab. Great PR opportunity for UDOT, UDWR & sportsmen's groups to collaborate on making the river great again!

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
							Several sections especially below Echo Reservoir: The construction of I-84 in the 1960s significantly impacted the Weber River. In several locations, especially near Henefer, the river was straightened resulting in stream degradation in the straightened segments and aggradations and lateral erosion in downstream reaches. Currently, most stream rehabilitation efforts are being funded by sportsman's dollars. Good floodplain connectivity will also reduce nearby flooding, protect people, home, and highway, and reduce roadbed erosion.	
Moderate	1-13	Deweyville	SR-38	11 to 16	Big Game Highway Safety	Deer	Deer migrate from Wellesville to Bear River floodplain/valley floor. Winter problem; road is at the edge of their winter range.	Slow speed to 45 mph or less (it is a residential area)

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-14	Grouse Creek	SR-30	3 to 6 9 to 33 47 to 56 62 to 88	Big Game Highway Safety Connectivity of Public Lands	Pronghorn Deer	Annual migration routes. Fences are being built now where there have not been any fences.	Require fencing with raised (14-16") smooth bottom wires. No net wire! Height should be 42". All new fences must meet above specs. Height is 51" – 54" where they are putting in fences now. Modify existing fence from 54" to 42"
Moderate	1-15	Corinne	SR-13	6 to 7	Big Game Highway Safety	Deer	20 to 30 deer killed per year from 2600 West to Corinne (3800 West). Resident deer travel corridors of the Bear River drainages and slough.	Lights or sensors
Moderate	1-16	Snowville	I-84	16 to 39	Big Game Highway Safety Connectivity of Public Lands	Deer Elk Short-eared Owls	Deer migration from ID into UT for the winter. 10% of deer population is killed from Nov to March. Deer migrate from Idaho to Utah to winter. Significant Elk winter range north of I-84.	Fencing and Overpasses Large Flashing Signs
Moderate	1-17	Plymouth	I-15	384 to 398	Big Game Highway Safety	Deer	10 to 20 deer killed annually between R.P. 384 & 390 – Malad River Corridor. These are mostly resident deer. Some winter migration occurs between R.P. 384 & 390.	Need deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

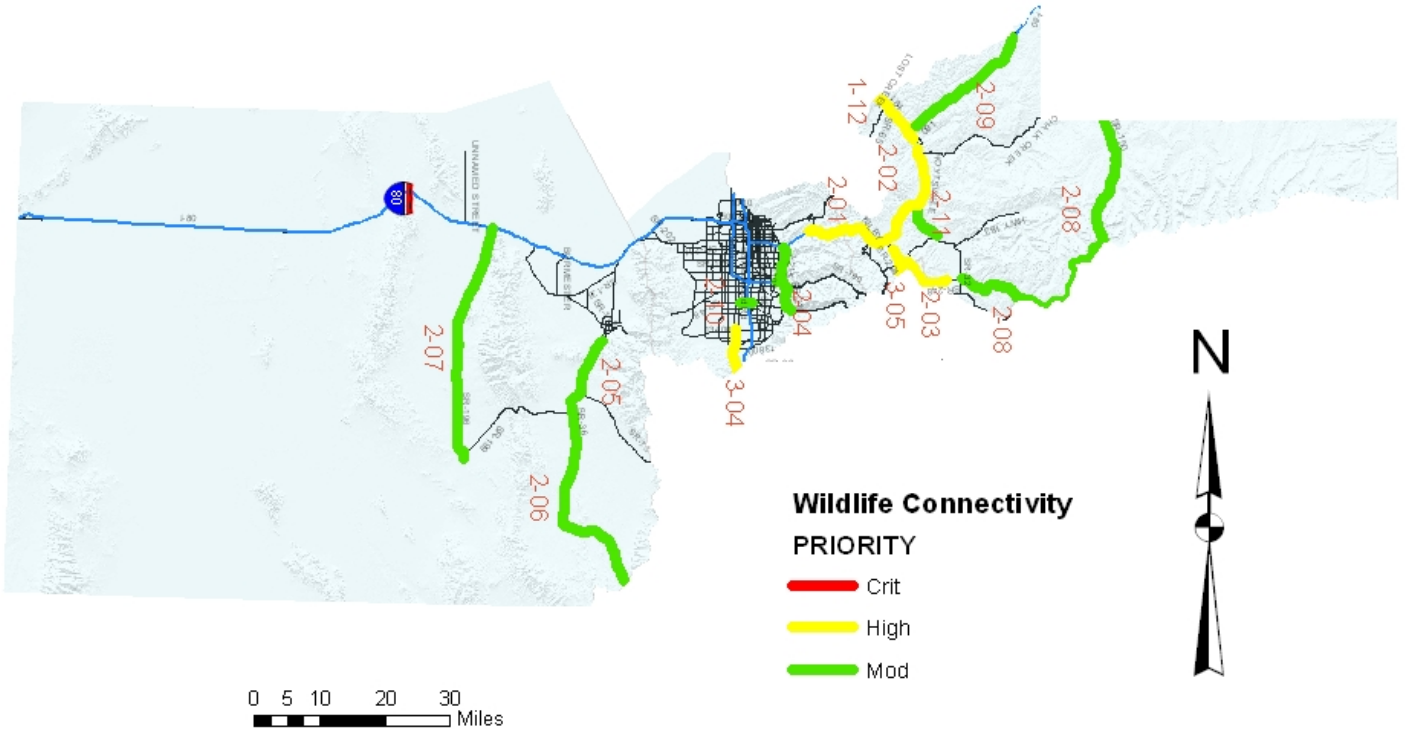
Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-18	East of Woodruff	SR-39	62 to 63	Big Game Highway Safety	Deer	15 – 20 killed per year. Deer cross highway in mornings and evenings to feed in adjacent fields. Deer are present during winter and early spring and then migrate to the top of Monte Cristo. Some deer are resident year round. This herd unit is under objective; we don't want to further reduce #'s.	Seasonal, flashing warning signs might help.
Moderate	1-19	East Bear Lake	Cisco Road	0 to 12+/-	Big Game Highway Safety	Deer	50+ killed each year. A group of resident deer cross road in evenings to drink from Bear Lake. Deer also migrate to this area during wintertime and spend the entire winter in the area.	Signs Reduce speed or better enforcement Heat/movement sensors
Moderate	1-20	Huntsville	SR-39	20 to 23	Big Game Highway Safety	Deer	50 to 75 deer killed each year Deer cross between Monastery & Green Hills Subdivisions. Migrating animals mostly (spring & fall) but some yearlong issues.	A few years ago, UDOT put up flashing signs. This has seemed to help reduce mortality.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-21	Logan Canyon	U.S. 89	389 to 413	Big Game Highway Safety	Deer Elk	Tony Grove turnoff area (the large flat) Just west of Garden City (where switchbacks & flat areas are) East of Logan – John Bissionnette was going to ask the lady doing the doe study what type of mortality she had on her collared deer. Deer are resident; elk are more seasonal. Tony Grove area is a summer range area so movements are across the highway. Garden City area is winter range area. Elk feed in raspberry fields, then cross highway	Slow people down! Flashing lights may work.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	1-22	Smithfield to Richmond	U.S. 91	35 to 39	Big Game Highway Safety	Deer Elk	Seasonal migrations for deer & elk (spring & fall). Some deer become resident and become a yearlong problem (dairies & haystacks). Animals are coming from USFS lands and cross to the Bear River floodplain. Depending upon snow amount, could have hundreds killed during a season. These are in the Cache Valley deer herd which is under objective & sportsmen want UDWR to increase herd #'s.	Work on highway is starting now for road widening, so something should be done now. Not sure what the solution is!
Moderate	1-23	Rockport	SR-32	22 to 29	Big Game Highway Safety	Deer	75 – 100 deer killed/year. Spring and summer mortality as they come down to drink at reservoir (Rockport)	Develop water sources on west side of levy to keep deer on west side. Deer crossing signs.

UDOT REGION 2

Wildlife Connectivity Region Two



Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	2-01	Echo Canyon	I-80	134 to 166	Big Game Highway Safety	Deer Elk Moose Marmot	I-80 separates high country (summer range) from lower range. A real challenge in Silver Creek Canyon. Narrow canyon with steeper road cuts and freeway lanes divided by stream and rails to trails route. Coalville valley very flat, private land. Animals (primarily elk) migrate across I-80 to access lands on both sides of freeway late spring and early fall. In heavy snow winters, animals tend to bunch up around Echo Reservoir, especially the area below the dam. In one winter, we lost at least 15 bull elk (that we know of). Public also slows down to watch animals and this creates traffic problems. Historically, we could pick up 5 deer a night during the winter. About 300 deer are killed a year in this area during a normal, average snow year. More during heavy winter periods. Round Valley area historical (1970s) pick up 100 deer a month..	Underpasses/overpasses and fencing Some type of crossing to facilitate movement between both sides of I-80. Several crossings needed w/high fences to keep animals off road. Large flashing signs for crossings

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	2-02	Echo Junction	I-80/ I-84	166 to 170/ 120 to 121	Big Game Highway Safety	Deer Elk Moose	Deer are being killed crossing interchange, 2 freeways. Large interchange for I-80 & I-84.	Possibly the best solution is to fence off the entire interchange, forcing animals to cross where the right-of-way is narrower.
High	2-03	Jordanelle	SR-248	3 to 12	Big Game Highway Safety	Deer	Winter range to summer range. Road bisects passage. Current crossings could be made more effective and longer. This is the area where deer proof fences and "bubblers" were put in to funnel deer across the highway. Deer are still being killed in this area.	Area should be modified and underpasses/ overpasses installed.
Moderate	2-04	Mouth of Parleys to Mouth of Little Cottonwood Canyon	I-215/ SR-190/ SR-210	1 to 7/ 0 to 2/ 0 to 4	Big Game Highway Safety	Deer Elk Moose	I-215 separates winter and summer ranges. Mouth of Parley's is a large interchange with steep road cuts. Urban with development on both sides of road. A real big challenge.	Possibly the only thing to do is fence off the entire interchange, forcing animals up or down the ROW where an easier crossing might be facilitated. I-215/SR-210 to mouth of Little Cottonwood Canyon.
Moderate	2-05	Stockton to Tooele	SR-36	47 to 52	Big Game Highway Safety	Deer Elk	Deer & Elk use these lower hills in some winters. Bull elk have habituated to the roadside causing problems	Suggest motion sensing flashing warning signs. Might put up deer-proof fencing along some portions.

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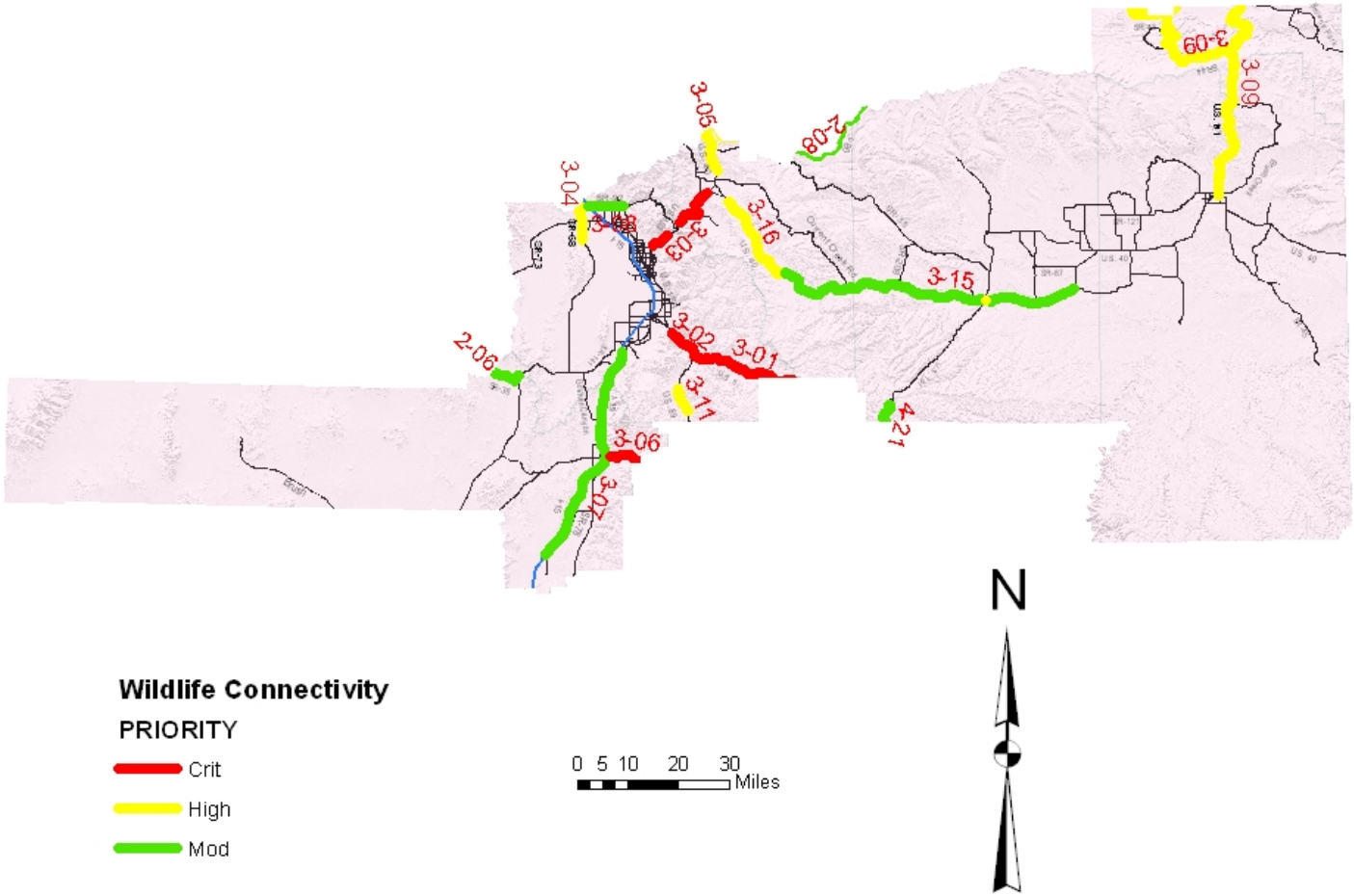
Moderate	2-06	Rush Valley	SR-36	0 to 47	Big Game State or Federal Sensitive Species	Pronghorn		Highway fencing should be modified to meet the needs for antelope movement. Minimum 16” lower clearance and smooth wire. See UDWR for details
Moderate	2-07	Skull Valley	SR-196	0 to 37	Big Game State or Federal Sensitive Species	Pronghorn		Highway fence should meet standards for antelope movement. 16” clearance below the bottom wire. Smooth wire.
Moderate	2-08	Mirror Lake Highway	SR-150	0 to 55	Big Game State or Federal Sensitive Species	Deer Elk Moose Bear Cougar Bobcat Wolf?	Highway bisects large tract of forested lands.	The highway should not become a barrier in the future.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	2-09	Lower Echo Canyon	I-80	169 to 190	Big Game Connectivity to Public Lands	Deer Elk Moose Fish Songbirds Amphibians	Historically, a significant amount of herbicide, sprayed along I-80, has drifted into the riparian area. This was a significant factor in our loss of woody vegetation, and potentially continues to limit re-vegetation efforts. Perhaps a combined effort on this stream to restore the stream channel and riparian vegetation would be appropriate. This is a major gateway into the state from the east. It seems like it would behoove the state to have a properly functioning stream with adequate habitat for aquatic and terrestrial animals as the first thing people see when they enter Utah.	Reduce spraying activities to those immediately necessary adjacent to the roadbed. Reduce herbicide drift. Having stable stream channels also saves UDOT money on less potential flooding of roadways and erosion into embankments. Using less herbicide saves state money. It would be great if UDOT could participate in proposed restoration efforts.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	2-10	Jordan River at 9000 South	SR-209	6 to 8	Big Game Safety Connectivity to Public Lands	Deer	This area is just east of the Jordan River. There were commercial greenhouses at the SE corner that had been there for years. Large trees bordered them on the east. In the last 3 years, as the greenhouses were removed and an office building and large box store constructed, 2 does and a buck, plus a skunk have died trying to cross 9000 South Street. There is still some riparian habitat left, though it's vanishing.	Suggest UDWR trap and relocate animals.

REGION 3

Wildlife Connectivity Region 3



Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	3-01	Spanish Fork Canyon	U.S. 6	183 to 208	Big Game Highway Safety Federal T&E Species Other State Sensitive Species Connectivity to Public Lands	Deer Elk Cougar Ute Ladies Tresses Clay Phacelia Black Bear Wild Turkey Moose	Big game herds have both mass migration and static movements across the highway. Spiranthes diluvialis occurs along lower sections of Soldier Creek and could be impacted by highway projects. Great Western Trail is disjunct at the highway. This is an important seasonal migration area for big game and their predators. Deer & elk move into this area in late fall & again in the spring. During this time, there are daily movements back and forth. With improved road conditions and increased traffic levels, this is becoming one of the most serious wildlife connectivity issues in the state.	Need wildlife crossings, fencing, escape ramps
Critical	3-02	Mouth of Spanish Fork Canyon	U.S. 6	179 to 183	Big Game Highway Safety Other State Sensitive Species Connectivity to Public Lands	Deer Elk Cougar Bear	Herds winter in the lower hills and move about during this time. The cougar follow the deer.	Need deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	3-03	Deer Creek	U.S. 189	8 to 11 & 16 to 26	Big Game Highway Safety Other State Sensitive Species	Deer Elk Sage Grouse	Deer and elk winter in the surrounding hills and cross the highway creating a hazard. Sage grouse habitat is of critical concern due to declining populations. 2004 road kill data suggests that 92 mule deer kills occurred between mileposts 8 to 11, and milepost 26 had 30 deer kills.	Impacts to land should be minimized.
High	3-04	Jordan Narrows	SR-68	29 to 43	Big Game Highway Safety Other State Sensitive Species	Deer	Resident deer population is safety hazard on road. 14 deer kills were recorded along SR-68 in 2004.	Signs and flashers have had little change to the situation.
High	3-05	Jordanelle	U.S. 40	2 to 15	Big Game Highway Safety Other State Sensitive Species	Deer Elk Moose Marmot	A single herd of deer that seasonally migrates from higher range in Park City to lower range in Jordanelle in the Fall, causes a safety hazard.	Existing crosswalks don't work. Current crossings could be made more effective and lengthen the area where crossings are installed.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	3-06	Fountain Green	SR-132	35 to 51	Big Game Highway Safety Other State Sensitive Species	Deer	This is a small 2-lane highway with little traffic but lots of road kill. Deer winter in the valley and in the Spring. In 2004, 23 big game animals were killed between reference posts 35 to 37, while 63 were killed between 47 to 51. This area is a major wintering hub for mule deer that come from several management units. As a result, we feel that the priority of this linkage should be elevated from high to critical as approx. 250 big game animals were killed between reference posts 35 to 51 in 2004 alone.	Suggest seasonal, flashing warning signs. Perhaps look into installing deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

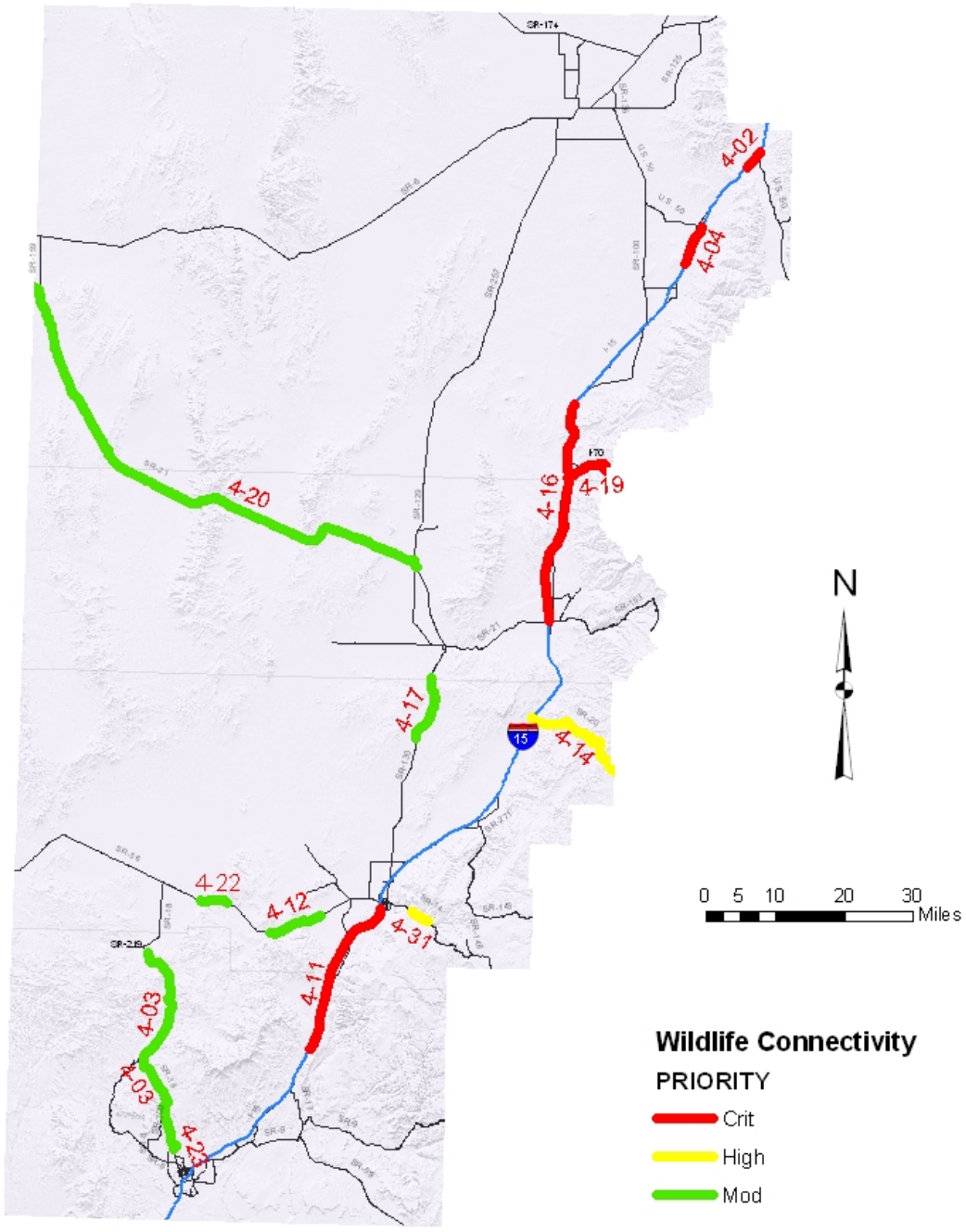
Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	3-07	Santaquin to Mills Jct.	I-15	203 to 250	Big Game Highway Safety Connectivity to Public Lands	Deer Elk	This entire segment is with Type G deer barrier fence. A DRAFT report titled: "Juab Valley Wildlife Conservation Project" has been prepared and requires internal review prior to release and submission. Will be available to UDOT in the near future. Major problem is maintenance of deer and elk east-to-west migration across Juab Valley. Private irrigated lands, big game depredations, illegal cross fences, and other barriers inside otherwise underpass structures. Previous fires, and no CUP water magnify the management problems of big game because of range deterioration.	Need to discuss before any actions are taken on the ground with private landowners. Urgent need for fence along big game migration corridors to get animals across croplands to their ancestral winter range and return to summer range annually.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	3-08	Alpine Highway	SR-92	0 to 7	Big Game Highway Safety Other State Sensitive Species	Deer	Urbanization from all directions has consumed deer winter range. Increased traffic has resulted in increased deer hits. Within 10 years, the area will be developed and only a small urban population of deer will exist.	Increase flashers and signs temporarily
High	3-09	Daggett County	U.S. 191 SR-44 SR-43	202 to 253 0 to 28 0 to 10	Big Game Highway Safety Other State Sensitive Species Connectivity to Public Lands	Deer Elk Moose Bighorn Sheep Cougar Black Bear Wolverine (possible)	Highways 191, 44, and 43 bisect important large tracts of public lands..	Improvements to these roads should not restrict movements of wildlife or fish species
High	3-11	Birdseye	U.S. 89	266 to 271	Big Game Highway Safety Connectivity to Public Lands	Deer	58 big game road kills were recorded along this 5-mile stretch in 2004.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

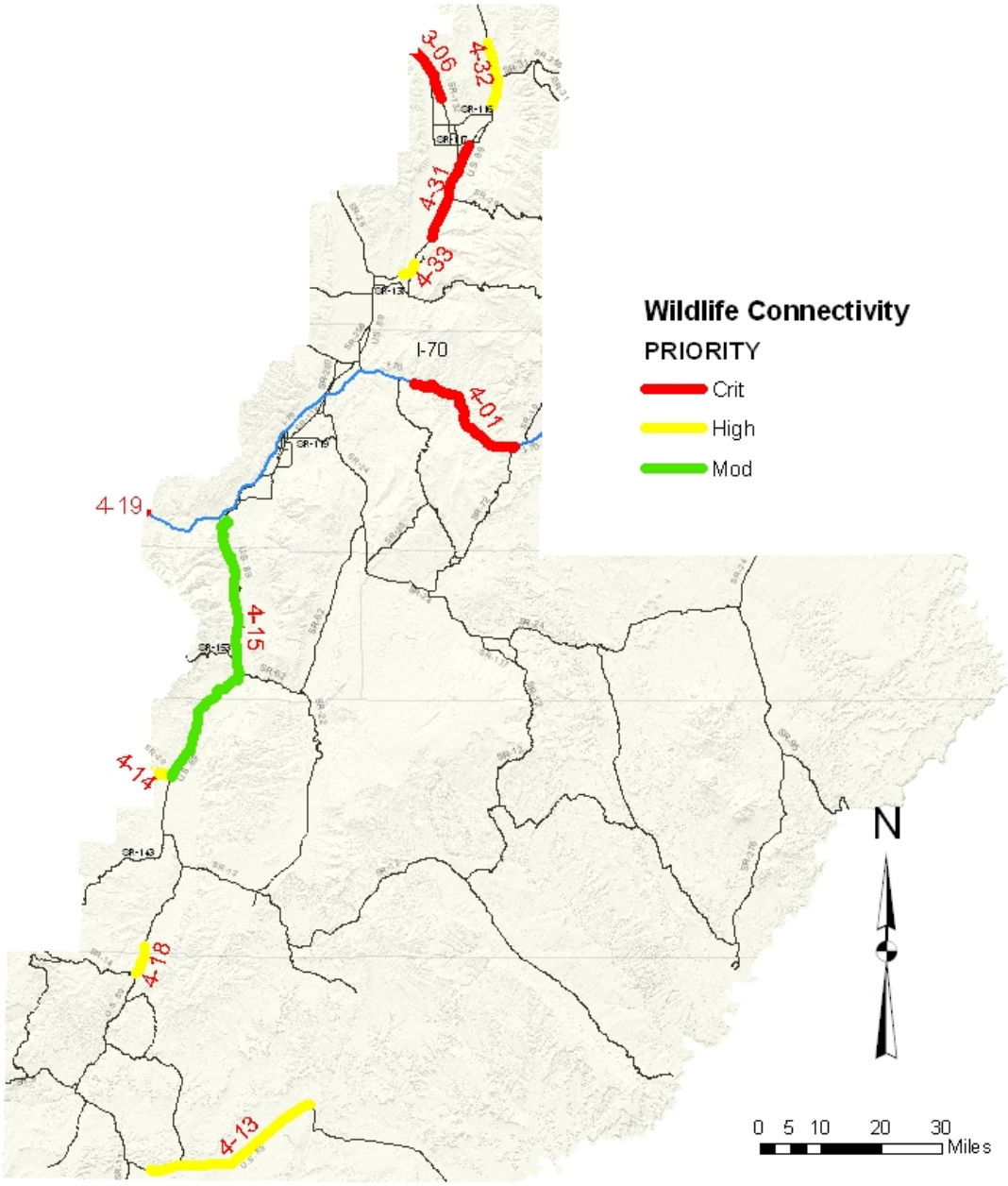
Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	3-14	Levan	SR-28	26 to 31	Big Game Highway Safety	Deer	The highest number of road kills occurred between this 5-mile stretch (58), although a fairly steady number of road kills occurs all along SR-28 from Nephi at reference post 38 to 16 at the Juab/Sanpete County line.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
Moderate	3-15	Strawberry to Myton	U.S. 40	42 to 105	Big Game Highway Safety Connectivity of Public Lands	Deer Elk?		Revise exact mileposts and possible elk problems with Steve Brayton with UDWR in Vernal.
High	3-16	Daniel's Canyon	U.S. 40	23 to 42	Big Game Highway Safety Connectivity of Public Lands	Deer Elk	Big game use this area as migration routes going higher summer/transitional ranges to wintering areas.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

REGION 4

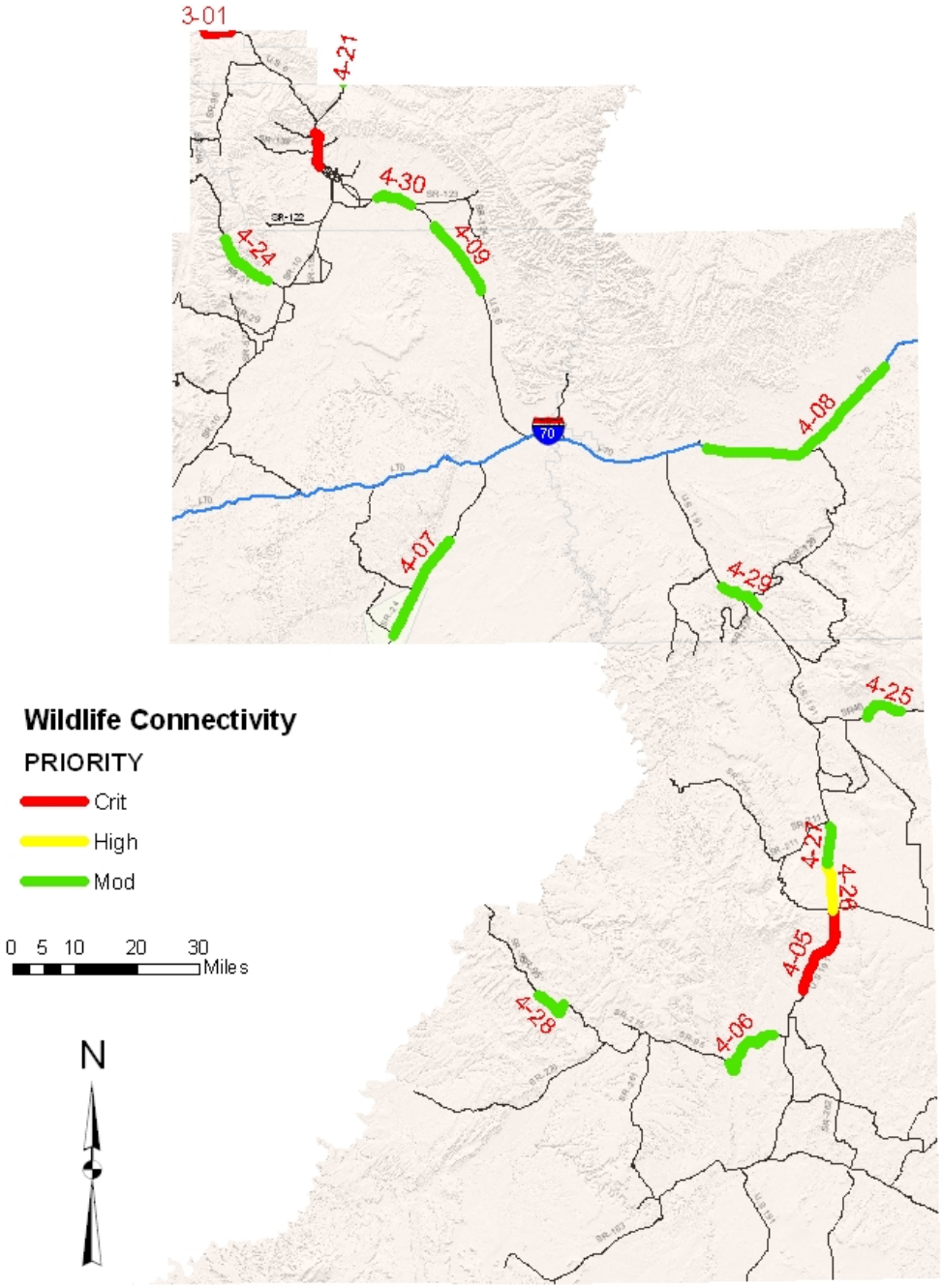
Wildlife Connectivity Region 4
Cedar City District



Wildlife Connectivity Region 4
Richfield District



Wildlife Connectivity Region 4
Price Dist



Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	4-01	Upper Salina Canyon	I-70	64 to 86	Big Game Highway Safety	Deer Elk Cougar Black bear	Type G deer proof fence presently being installed in lower 6.7 miles of canyon tied into existing structures. High mortality for more than 30 years due in part to coal haul trucks traveling I-70. Some deer and elk highway mortality from Salina Creek to east slope near highway 10 and 72. Deer and elk movements and migrations north to south seasonally.	Urgent need to complete type G deer proof fence with some new over and/or under passes from just above Gooseberry up to and beyond the summit. Location of new structures to be determined.
Critical	4-02	Scipio	I-15	187 to 190	Big Game Highway Safety	Deer Elk Cougar	Forest Service Lands on both sides of freeway. I-15, Scipio Pass Interchange, overpass, presently is a potential deer/elk passage structure, but semi truck and trailers and other vehicles are using the interchange ramp roads for a parking area, negatively impacting the potential for deer/elk use of this structure. In early planning by UDWR, I personally identified Scipio Pass as a major deer migration area. Now it is lost to disturbance of the parked trucks and other vehicles.	The Scipio Pass Summit interchange overpass could be utilized by deer and elk if the unlawful parking could be relocated to a nearby parking area south or north of Scipio Pass. Screening on the parapet wall fences and about 100 yards along he freeway ROW would screen the traffic from the using big game animals.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	4-03	Highway 18	SR-18	5 to 39	Big Game Federal T&E Highway Safety Other State Sensitive Species Connectivity of Public Lands	Deer Gray fox Small mammals Desert tortoise	Migration corridor for deer along the east and west Pine Valley forests – mainly during spring and fall migration, and to a lesser extent during summer.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
Critical	4-04	Holden	I-15	170 to 176	Big Game Highway Safety Connectivity to Public Lands	Deer Elk	West side of I-15 is fenced, east side is not. Elk continue to cross the road overpass during the night then attempt to cross back in the morning. They stack-up against the inside of the deer-proof fence on the west side. Elk have leaped off in the past and been killed, and caused accidents.	Needs deer fence on both sides of the freeway with escape ramps, and overpass fencing. The overpass also needs side fencing installed..
Critical	4-05	Devil's Canyon, to Monticello	U.S. 191	58 to 72	Big Game Highway Safety Connectivity to Public Lands	Deer Elk Turkey Cougar	Important seasonal movement from west (higher elevation) to east (lower elevation) in winter. This becomes more critical during heavy snow years. Elk, deer, and turkey – followed by lions. Mule deer migration route crosses U.S. 191 for several miles here.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	4-06	Comb Wash & Black Mesa	U.S. 95	107 to 119	Big Game Highway Safety Connectivity to Public Lands	Deer Cougar Gray Fox	This area is a medium priority with current road design speed and traffic levels. Comb Wash and Cottonwood Wash provide connection between higher elevation areas of Elk Ridge and the Abajo Mountains, and lower elevation areas to the south. Few (relatively speaking) animals move across this corridor, but it does provide connectivity north to south. Black Mesa area is a mule deer migration route.	Suggest seasonal, flashing warning signs.
Moderate	4-07	San Rafael Desert	U.S. 24	129 to 146	Big Game Highway Safety Connectivity to Public Lands	Pronghorn	This area is pronghorn habitat. There are small herds on both sides of Highway 24 with some movement across the highway. The road is presently fenced with 5 strands of wire on both sides. Currently, there are few collisions with pronghorn.	Make sure the bottom strand of wire is smooth. Suggest warning signs if they aren't already there.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	4-08	Cisco Desert	I-70	187 to 222	Big Game Federal T&E Other State or Fed Sensitive Connectivity of Public Lands	White-tailed prairie dog Pronghorn Golden eagle	There are populations of white-tailed prairie dogs on both sides of I-70. Additionally, there are populations of pronghorn on both sides of the interstate. This is a medium priority as far as safety and collisions, however it does present a barrier to population connectivity. Golden eagles winter in this area and are occasionally struck on the interstate when feeding on road-kill.	Suggest overpasses for pronghorn. They may not have to be as wide as deer and elk overpasses. Using existing vehicle overpasses might work if ROW is fenced off with pronghorn-proof fences.
Moderate	4-09	East Carbon to Woodside	U.S. 6	261 to 274	Big Game Connectivity of Public Lands	Pronghorn	This is a medium priority area. There are populations of pronghorn on both sides of the highway. Currently, the highway is fenced on both sides with 5-strand wire. This is a barrier to movement. UDWR manages these as separate herds due to the barrier.	Suggest overpasses for pronghorn. They may not have to be as wide as deer and elk overpasses. Using existing vehicle overpasses might work if ROW is fenced off with pronghorn-proof fences.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	4-10	Spring Glen to Helper	U.S. 6	220 to 226	Big Game Highway Safety Connectivity of Public Lands	Deer	This is a high collision area for deer. Deer seasonally move into this area and daily cross the highway. Spring (March & April) is the most concentrated. However, there are a few resident deer along the Price River and some collisions do occur throughout the year. Major east-west migration and daily migration to access water along Price River.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so. Perhaps, in this area, an overpass would help.
Critical	4-11	Black Ridge to Cedar	I-15	34 to 58	Big Game Highway Safety Other State or Fed Sensitive Connectivity of Public Lands	Deer Cougar Raptors	Deer migration route Yearlong wildlife/vehicle accident corridor. Most accidents occur during Spring and Fall migratory periods, but yearlong mortality in summer and winter also occurs.	Any fencing in this area must incorporate mitigation measures for deer and other wildlife such as underpasses or overpasses.
Moderate	4-12	Highway 56 Corridor	U.S. 56	43 to 51	Big Game Highway Safety Connectivity of Public Lands	Deer Pronghorn	Important deer and pronghorn migratory area. Deer/vehicle accident rate is significant.	Suggest overpasses for pronghorn. They may not have to be as wide as deer and elk overpasses. This might work if ROW is fenced off with pronghorn-proof fences on both sides of the ROW.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	4-13	Fivemile	U.S. 89	30 to 60	Big Game Highway Safety Connectivity of Public Lands	Deer Cougar	Major migratory corridor for deer. Highway 89 runs straight through the major migratory route for the Paunsaugunt deer herd. Bimodal Spring (March) and Fall (October) migration. High profile, world recognized trophy deer herd. If coal reserves were developed on Smoky Mountain/Alton, haul truck traffic would make this area a critical priority.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
High	4-14	Highway 20 Corridor	SR-20	0 to 21	Big Game Highway Safety Other State or Fed Sensitive Connectivity of Public Lands	Deer Elk Sage Grouse Cougar	The design updates to this highway have increased traffic speeds and wildlife/vehicle collision rates. Deer, elk, and sage grouse cross the highway during migratory seasons.	Suggest seasonal, flashing warning signs. Maybe they can be motion-sensor activated.
Moderate	4-15	U.S. 89 from I-70 to SR-20	U.S. 89	142 to 191	Big Game Highway Safety Connectivity of Public Lands	Deer Elk	Year round deer mortality. In the Summer months, deer are crossing highway 89 to water at the river. During the Winter, deer stack up along the highway corridor due to snow at higher elevations. In the Spring, deer are attracted to the early green grass along the highway shoulders	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Critical	4-16	Baker Canyon	I-15	111 to 144	Big Game Highway Safety Other State or Fed Sensitive Connectivity of Public Lands	Deer Elk Cougar	Big game migration corridor.	If fences are added, need overpasses and/or underpasses and deer escape ramps.
Moderate	4-17	Minersville Summit	U.S. 130	27 to 37	Big Game Highway Safety Other State or Fed Sensitive Connectivity of Public Lands	Deer Pronghorn Sage Grouse	Important deer, pronghorn, and sage grouse migration corridor.	Suggest seasonal, flashing warning signs for migrating deer and 5-strand fencing both sides of the ROW, with smooth bottom wire for pronghorn.
High	4-18	Long Valley Junction	U.S. 89	104 to 108	Big Game Highway Safety Connectivity of Public Lands	Deer Elk	Important mule deer migration corridor.	Needs deer signs with flashers.
Critical	4-19	Cove Fort	I-70	0 to 7	Big Game Highway Safety Connectivity of Public Lands	Deer Elk	Important deer and elk migration corridor.	Any fencing must incorporate under and/or overpasses and deer escape ramps.
Moderate	4-20	Garrison to Milford	U.S. 21	0 to 78	Big Game Highway Safety Connectivity of Public Lands	Pronghorn		Any fencing along this highway corridor must accommodate pronghorn migration.
Moderate	4-21	Avinaquin Ridge	U.S. 191	167 to 170	Big Game Connectivity of Public Lands	Cougar Black Bear Deer Elk Moose	This is a medium priority area. However, it does present a connectivity issue for large predators, and to a lesser extent, big game, crossing the highway following Avinaquin Ridge. Current traffic levels are low.	Suggest deer-proof fencing with wildlife crossing structure.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	4-22	Newcastle	U.S. 56	31 to 35	Big Game Highway Safety Connectivity of Public Lands	Deer	Important deer migratory route. Wildlife/vehicle collisions occur from October through May with the peak of the mortality occurring November through January.	Suggest seasonal, flashing warning signs.
Moderate	4-24	Huntington Canyon	SR-31	35 to 45	Big Game Connectivity to Public Lands	Deer	Canyon with deer crossing regularly to either side.	Suggest motion-sensor activated, flashing warning signs
Moderate	4-25	Old LaSal	SR-46	10 to 17	Big Game Highway Safety Other State or Fed Sensitive Connectivity of Public Lands	Deer Elk Sage Grouse	Summer range to north, winter range to south. Definite migration area.	Suggest seasonal, flashing warning signs
High	4-26	North of Monticello	U.S. 191	72 to 80	Big Game Highway Safety Connectivity of Public Lands	Deer Elk	Deer/Elk crossing is heavy in this area.	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
Moderate	4-27	Church Rock	U.S. 191	80 to 85	Big Game Highway Safety Connectivity of Public Lands	Pronghorn	Pronghorn cross the highway in this area. Movement is mostly west to east.	Suggest motion-sensor activated flashing warning signs. Fencing should be 5-strand with smooth bottom wire.
Moderate	4-28	Fry Canyon	U.S. 95	67 to 95	Big Game Highway Safety Connectivity of Public Lands	Desert Bighorn Sheep	Sheep cross the highway here. Herds are on both sides of the road.	Suggest motion-sensor activated flashing warning signs.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
Moderate	4-29	Arches National Park	U.S. 191	127 to 133	Big Game Highway Safety Connectivity of Public Lands	Desert Bighorn Sheep	Sheep cross the highway to link to Potash Herd and vise-versa.	Suggest motion-sensor activated flashing warning signs.
Moderate	4-30	Cat Canyon	U.S. 6	238 to 242	Big Game Highway Safety Connectivity of Public Lands	Deer	Deer migration north to south.	Suggest seasonal, flashing warning signs. Also need deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
High	4-31	Cedar Canyon	SR-14	4 to 6	Big Game Highway Safety Connectivity of Public Lands	Merriam's wild turkey Deer	High concentration of wintering Merriam's wild turkey and mule deer from Right Hand Fork to 2 miles above Milt's Stage Stop restaurant. High kill potential for wild turkeys from Nov. 15 – April 30 each winter.	Suggest 8 flashing signs be installed and flashers run from Nov. 15 – April 30.
Critical	4-31	Ephraim/ Manti	U.S. 89	221 to 238	Big Game Highway Safety Connectivity to Public Lands	Deer Elk	236 big game road kills were recorded along this 17-mile stretch in 2004. The highest number of animal/vehicle collisions occurred between reference posts 221 to 227 (63) and 231 to 238 (162).	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.
High	4-32	Fairview	U.S. 89	246 to 257	Big Game Highway Safety Connectivity to Public Lands	Deer	128 big game road kills recorded here in 2004 along this stretch. The highest number of animal/vehicle collisions occurred between reference posts 246 to 249 (52), and 254 to 257 (48).	Suggest seasonal, flashing warning signs. Might also consider deer-proof fencing with escape ramps and some kind of crossing structure every mile or so.

Priority	Linkage Area	Name	Route	Reference Posts	Conservation Issue	Species of Concern	Comments	Recommendations
High	4-33	Gunnison	U.S. 89	213 to 216	Big Game Highway Safety	Deer	53 big game road kills were recorded here in 2004.	Suggest seasonal, flashing warning signs.